

## REMARKS

Claims 52-64 were pending when last examined. Claim 52 has been canceled. Claims 53-57, 60, 62, and 64 are amended.

### Specification

The Office Action of December 2004 stated that a new abstract is required that is clearly indicative of the invention to which the claims are directed. Applicant traverses this rejection on the basis that the Abstract is an Abstract of the *Disclosure*, not an Abstract of the claimed invention. 37 CFR 1.72(b) states the following:

A brief abstract of the *technical disclosure in the specification* must commence on a separate sheet .... The purpose of the abstract is to enable the United States Patent and Trademark Office and the public generally to determine quickly from a cursory inspection the nature and gist of the technical disclosure.

Given that both a semiconductor device and a method of making such device are disclosed in the specification, Applicant believes that the Abstract is already in compliance with 37 CFR 1.72(b). Therefore, there is no need to amend the Abstract.

### Allowable Subject Matter

Applicant thanks the Examiner for indicating that Claims 56 and 60-61 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claims 56 and 60 have been amended in accordance with the Examiner's suggestion and are now in condition for allowance. Claim 61 depends from Claim 60.

### Claim Rejections -- 35 USC § 103

#### 1. Claims 52-54, 57-58, and 62-64

Claims 52-54, 57-58, and 62-64 are rejected under 35 USC § 103 as being unpatentable over the Background of Invention section of the application ("Background") in view of U.S. Patent No. 5,626,688 to Probst et al. ("Probst"). Although Claim 56 is also indicated as being rejected on page 3 of the Office Action, Applicant assumes that this is due to a typographical error because

Claim 56 is indicated to be allowable if written in independent form, and this is consistent with the Office Action Summary.

Claim 52 is canceled.

Claim 53 is patentable over the combination of Background and Probst at least because it recites, “at least one barrier layer made substantially of a transition metal nitride material...” The Background discloses a metallic layer of molybdenum but does not teach or suggest a barrier layer of transition metal nitride. Probst, similarly, discloses a chalcopyrite layer but not a “barrier layer of a transition metal nitride.” Probst discloses a diffusion barrier layer made of combinations of titanium nitride (which is a transition metal nitride) with other compounds [see Probst, col. 6, lines 2-8], but not teach or suggest a layer that is *substantially* titanium nitride.

The disclosure in Probst strongly indicates that a “barrier layer made substantially of a transition metal nitride material” was not contemplated by Probst. The enhanced back reflectivity provided by the substantially pure transition metal nitride material is an important reason behind the enhanced performance of the solar cell recited in Claim 53. However, the reflectivity of the combination-type materials listed in Probst’s col. 6, lines 2-8 are generally poor reflectors that would not serve the function of the barrier material recited in Claim 53. The list of suggested materials in Probst suggests that improved back reflectivity was not a concern of Probst. Thus, Claim 53 is patentable over the combination of Background and Probst.

Claims 54, 57, 58, and 62-64, all of which depend from Claim 53, are patentable over the combination of Background and Probst for the same reasons as Claim 53.

## 2. Claims 55 and 59

Claims 55 and 59 are rejected under 35 USC § 103 as being unpatentable over the Background in view of Probst and further in view of the fact that it would have been obvious to one having ordinary skill in the art to form the barrier layer comprising zirconium nitride. Page 6 of the Office Action states that “zirconium nitride is commonly used to prevent undesirable reactions in the contact region.”

Applicant traverses this rejection on the ground that a mere statement that zirconium nitride is commonly used to prevent undesirable reactions in the contact region is not a sufficient basis for a rejection. MPEP 2144.03 states:

It is never appropriate to rely solely on ‘common knowledge’ in the art without evidentiary support in the record, as the principal evidence upon which a rejection was based.... As the court held in [*In re Zurko*, 258 F.3d 1379 (Fed. Cir. 2001)], an assessment of basic knowledge and common sense that is not based on any evidence in the record lacks substantial evidence support.

Based on MPEP 2144.03, Applicant respectfully requests substantial evidence (e.g., citation to a document) to support the assertion that using zirconium nitride in the invention would have been obvious to a person of ordinary skill in the art.

Even assuming, *arguendo*, that zirconium nitride is commonly used to prevent undesirable reactions in the contact region, there was still no motivation to use zirconium nitride in the solar cell of the type disclosed in the Application at the time of the invention. As indicated by the existence of the prior art solar cells of the type shown in FIG. 1, undesirable reactions between layers was not a significant problem. Given that undesirable reactions did not pose a problem, there would be no reason for someone to add zirconium nitride to prevent the undesirable reactions.

While the high reflectivity of the zirconium nitride layer improves a solar cell’s performance, it was not known at the time of the invention that adding a highly reflective layer would improve performance. Metals that are used to make the solar cell, such as molybdenum (Mo), are generally reflective when alone in the air. However, when they are combined with a p-type semiconductor, the reflectivity at the interface between the Mo and the p-type semiconductor is significantly lower than the reflectivity of Mo alone in the air. This lowered reflectivity in combination with the p-type semiconductor, however, was not well known at the time of this invention. In fact, it was commonly assumed that the reflectivity of Mo in the air would not be dramatically different from its reflectivity in the solar cell. This invention, which adds a zirconium nitride layer (or any other transition metal nitride layer) to the solar cell, is based on the discovery that the reflectivity at the interface between the Mo and the p-type semiconductor is poorer than once assumed, and that enhancing the reflectivity at the interface would achieve improved performance.

For the foregoing reasons, there was no motivation to add zirconium nitride to a solar cell at the time of the claimed invention.

### Conclusion

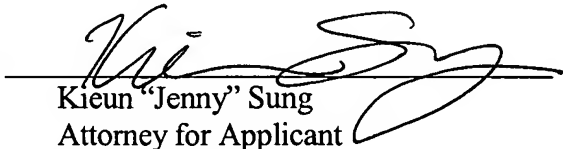
Based on the foregoing reasons, Claims 53-64 are in condition for allowance. Please telephone the undersigned attorney at (650) 833-2121 if there are any questions.

Respectfully submitted,

DLA PIPER RUDNICK GRAY CARY US LLP

Dated: 3/7, 2005

By

  
Kieun "Jenny" Sung  
Attorney for Applicant  
Reg. No. 48,639

DLA PIPER RUDNICK GRAY CARY LLP

Attn: Patent Department

2000 University Avenue

East Palo Alto, CA 94303

Telephone: (650) 833-2121

Facsimile: (650) 833-2001